

## Rumrill, Nancy

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**From:** Jennifer Saran <JenniferSaran@florencecopper.com>  
**Sent:** Wednesday, September 23, 2020 5:16 PM  
**To:** Rumrill, Nancy  
**Cc:** Brent Berg; greenslade.maribeth@azdeq.gov  
**Subject:** RE: request for approval for use of CO2

Hi Nancy,

Please see below for answers to your most recent questions:

1. The volume of liquid CO2 used in each well will be approximately equal to the wellbore volume. Given that the diameter of the PTF well bores are 12.25-inches, this means that approximately 1.25 cubic feet (9.35 gallons) of liquid CO2 will be used per foot of well screen treated.
2. The current plan is to treat the wells one time at the beginning of the flushing process to remove mineral solids that may have precipitated in the well screens. During normal ISCR operations this is accomplished by recirculating the injected solution.
3. The liquid CO2 will be allowed to flow down the injection string under the force of gravity, it will not be pumped down the well. When released into the well screen, a portion of the CO2 will solidify forming dry ice, which will sublime (gas off) over a period of time after application. Gas generated by the sublimation process will be vented to prevent excess pressure buildup.
  - a. Liquid CO2 is slightly heavier than water and weighs 8.47 lbs/gallon, water weighs 8.3 lbs/gallon.
  - b. The weight of water will generate 0.43 psi per foot of depth. Because liquid CO2 is slightly heavier than water, it will generate 0.44 psi per foot of depth.
  - c. The injection pressure limit at the PTF is 0.65 psi/foot of depth. The application of liquid CO2 under the force of gravity, into the open well casing, and without pressure confinement will not exceed the injection pressure limitation of 0.65 psi/foot of depth.
  - d. The wellbore will be open to the atmosphere preventing pressure buildup.
4. The CO2 is vented to the atmosphere during the well treatment process. The only other by-product is the solid mineral scale that will accumulate in the well casing, and which will be bailed from the well after treatment.

Perhaps we can take a few minutes to touch base on this request on our weekly call tomorrow – thanks!  
Jennifer

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**From:** Rumrill, Nancy <Rumrill.Nancy@epa.gov>  
**Sent:** Tuesday, September 22, 2020 5:34 PM  
**To:** Jennifer Saran <JenniferSaran@florencecopper.com>  
**Cc:** Brent Berg <BrentBerg@florencecopper.com>; greenslade.maribeth@azdeq.gov  
**Subject:** RE: request for approval for use of CO2

Hi Jennifer,

A few more clarifications. How much liquid CO2 is used in a well? Which wells are treated: injection and/or recovery wells? How often would these CO2 treatments occur? Are the pressures less than the maximum allowable pressures, per Part II.E.4.a of the permit, exerted on the injection zone? Is all of the CO2 or byproducts recovered? This additional injection activity will be a minor modification of the permit based on the information submitted.

Thanks, Nancy

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Nancy Rumrill ([rumrill.nancy@epa.gov](mailto:rumrill.nancy@epa.gov))  
Groundwater Protection Section (WTR-4-2)  
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**From:** Jennifer Saran <[JenniferSaran@florencecopper.com](mailto:JenniferSaran@florencecopper.com)>  
**Sent:** Tuesday, September 22, 2020 3:38 PM  
**To:** Rumrill, Nancy <[Rumrill.Nancy@epa.gov](mailto:Rumrill.Nancy@epa.gov)>  
**Cc:** Brent Berg <[BrentBerg@florencecopper.com](mailto:BrentBerg@florencecopper.com)>; [greenslade.maribeth@azdeq.gov](mailto:greenslade.maribeth@azdeq.gov)  
**Subject:** RE: request for approval for use of CO2

Hi Nancy,

Attached please find a response to your request for clarifications.

If you have any questions, or need additional information, please let me know.

Thanks!  
Jennifer

**Jennifer Saran** Environmental Manager



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**From:** Rumrill, Nancy <[Rumrill.Nancy@epa.gov](mailto:Rumrill.Nancy@epa.gov)>  
**Sent:** Friday, September 11, 2020 4:54 PM  
**To:** Jennifer Saran <[JenniferSaran@florencecopper.com](mailto:JenniferSaran@florencecopper.com)>  
**Cc:** Brent Berg <[BrentBerg@florencecopper.com](mailto:BrentBerg@florencecopper.com)>; [greenslade.maribeth@azdeq.gov](mailto:greenslade.maribeth@azdeq.gov)  
**Subject:** RE: request for approval for use of CO2

Hi Jennifer,  
I need a few clarifications on the addition of CO2. I would like to confirm that FCI intends to use CO2 gas (not liquid CO2) and to get description of the procedures for the treatment, such as how FCI plans to introduce the CO2 gas into the well casing and/or screened interval.  
Thanks, Nancy

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Nancy Rumrill ([rumrill.nancy@epa.gov](mailto:rumrill.nancy@epa.gov))  
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**From:** Jennifer Saran <[JenniferSaran@florencecopper.com](mailto:JenniferSaran@florencecopper.com)>  
**Sent:** Tuesday, September 8, 2020 3:43 PM  
**To:** Rumrill, Nancy <[Rumrill.Nancy@epa.gov](mailto:Rumrill.Nancy@epa.gov)>  
**Cc:** Brent Berg <[BrentBerg@florencecopper.com](mailto:BrentBerg@florencecopper.com)>; [greenslade.maribeth@azdeq.gov](mailto:greenslade.maribeth@azdeq.gov)  
**Subject:** request for approval for use of CO2

Good afternoon,

As discussed on Friday, attached please find a request for approval for the use of CO2 in well maintenance activities.

Please let me know if you have any questions – thanks,  
Jennifer

**Jennifer Saran** Environmental Manager



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